

# The largest war in Europe since World War 2: impact on the final year Ukrainian resident's competence acquisition

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## Research Article

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# Abstract

**Introduction.** The war affects access to all ordinary civil activities, including healthcare and education, due to multiple factors: physical injury and mental health consequences in students and teachers; the educational, healthcare, and non-healthcare critical facilities destruction; the safety issues while attending the classes. All these factors could have a negative impact on medical education. It is especially crucial, since the necessities of the population in receiving health care only increase in war-affected countries. Therefore, it is essential to be able to continue providing medical education. The goal of the study was to identify if the full-scale ongoing war have an impact on final year residents-anaesthesiologists' competence acquisition and their ability to work independently.

**Methods.** This retrospective study started in 2021 to assess the competence acquisition and readiness for independent work in residents-anaesthesiologists after two years of residency. When Russia invasion have started in February 2022, the residency program also was changed - most live classes were replaced by online sessions, with increasing time of self-dependent work on the online platform, as well as time of practical work in the hospitals. Study was prolonged to investigate the war impact on 2022 final year residents. At first, we investigate if the war had an impact on OSCE results, comparing 2021 and 2022 years. Secondly, questionnaires were sent to all final year residents to reflect on the education quality, competence acquisition and readiness to work as an independent anaesthesiologist. Other questionnaires were sent to all teachers to assess the educational outcomes and war impact.

**Results.** 38 residents in 2021 and 36 residents in 2022 were included in the study. All of them have passed the OSCE.

The number of residents, who didn't pass the OSCE did not differ significantly ( $p = 0,9$ ). The number of residents who had 70–80% competence acquisition were a significant lower in 2022 year ( $p = 0,039$ , OR 0,36 95% CI 0,1 – 0,9), although the number of resident, who had 80–90% and more than 90% competence acquisition had a tendency to increase ( $p > 0,05$ ). The number of residents, who feel absolutely confident to provide anaesthesia for ASA 1–2 patients, ASA 3–4 patients and to work independently in the ICU, did not change significantly, although tended to increase in the 2022-year residents ( $p > 0,05$ ). When it comes to competence acquisition assessed by teachers: 44% accordingly stated that it was higher in 2022 residents comparing to previous years, while 63% answered that it remained the same. The readiness for independent practice teachers evaluate at the same level in residents-2022 comparing with residents-2021. Teachers and residents had similar reflection about the most effective type of learning, choosing the simulation training, live master classes and seminars in small groups, self-directed learning.

**Conclusion.** Anaesthesiology and intensive care residents could get all necessary competences and become ready for independent work during on-going full-scale war, with increasing part of practical work in the hospital, introduction flexible hospital practice places (temporary moving to safe country regions) and sparing more time to online sessions and self-directed study.

## Introduction

Ukraine has, over the years, become a popular student destination for primary medical education and residency. Its academic experiences, good infrastructure and easily accessible value-for-money education helped it to achieve the status of a global educational hub. Approximately 76 000 foreign students were enrolled in various undergraduate and postgraduate study courses as of late 2020, with medicine being the most popular study field [1]. In the 2017–2018 years, approximately 75000 Ukrainian students were attending medical faculties, with 6000 new residents attending postgraduate medical faculties each year.

According to the Armed Conflict Location & Event Data Project (ACLED), since 2019, more than 77 000 armed engagements have occurred across different regions of the world [2], however, the Russian invasion of Ukraine is the largest armed conflict in Europe since World War 2 and has caused at least 12 million people fled their homes, more than 28000 civilians and 10000 combatants killed, and near 100000 wounded [3].

The war affects access to ordinary civil activities, such as healthcare and education due to multiple factors: physical injury and mental health consequences to students and teachers; the destruction of educational, healthcare, and non-healthcare critical facilities; the safety issues while attending the classes; problems with basic electricity, water, food supply. All these factors could have a negative impact on medical education. It is especially crucial in the medical area since the necessities of the population in receiving health care only increase in war-affected countries. Therefore, it is essential to be able to continue providing education in the medical specialisation, thus increasing the amount of health care specialists.

The goal of the study was to identify if the full-scale ongoing war have an impact on second (final) year residents-anaesthesiologists' competence acquisition and their ability to work independently after finishing residency.

## Methods

The retrospective study was conducted at the postgraduate surgery, anaesthesiology and intensive care department at Bogomolets National Medical University (Bogomolets NMU). Study design was approved by Bogomolets NMU ethics committee (protocol #146, 07.09.21) and all methods were carried out in accordance with relevant guidelines and regulations (e.g. Declaration of Helsinki). The study started before the war to assess the competence acquisition and readiness for independent work in residents-anaesthesiologists after two years of residency. When the war began, the study was prolonged too, to investigate the war impact. Study was registered on [clinicaltrials.gov](https://clinicaltrials.gov) with registration number NCT05559593 and first registration date 29/09/2022.

In Ukraine we have a 2-year residency program in anaesthesiology and intensive care, it includes 12 months of a so-called educational part, which is provided by postgraduate faculties with rotation on different clinical departments of the faculty (like obstetric anaesthesiology, cardio anaesthesiology, intensive care, transplantology, thoracic anaesthesiology etc.), and 10 months of practical part – in one of the major acute hospitals. When Russia invaded Ukraine, 41 final-year residents were studying at the postgraduate department of surgery, anaesthesiology and intensive care at Bogomolets NMU. From the 5th day of the war education program was changed to online-based, including an interactive platform for distance learning, ZOOM-meeting for lectures and seminars, and individual work with teachers through online messengers and video calls. 30 (73%) residents and 3 (20%) teachers left Kyiv for 1,5 – 2 months due to the direct attack of the artillery, missile and troops, with occupied and destroyed Kyiv suburbs, where part of them was living. Those residents, who have left Kyiv, were distributed to hospitals in the Western part of Ukraine to continue their practice in anaesthesiology and intensive care departments. Residents, who stayed in Kyiv, were distributed to trauma and military hospitals, which had a lot of patients due to the ongoing war in the city.

After Ukrainian counter offences and Russian withdrawal from the Kyiv district, most of the residents and all teachers came back in April 2022. As a result, live practical sessions and master classes were restored to overtake the program, although we continued online learning with lectures, seminars and other activities. Accordingly, due to ongoing war, most live classes were replaced by online sessions, with increasing time of self-dependent work on the online platform, as well as time of practical work in the hospitals (Table 1).

Table 1

Study time distribution during the final 6 month of residency in anesthesiology and intensive care

	<b>Live classes (lecture, seminar)</b>	<b>Live classes (work-shop, simulation)</b>	<b>Online session (lecture, seminar)</b>	<b>Self-directed study (online platform)</b>	<b>Practical work in the hospital</b>	<b>Total</b>
2020	123 (13%)	273 (29%)	100 (11%)	40 (4%)	400 (43%)	936
2021	80 (9%)	250 (27%)	120 (13%)	60 (6%)	426 (46%)	936
2022	40 (4%)	70 (7%)	183 (20%)	120 (13%)	523 (56%)	936

After passing the OSCE exam, we send questionnaires to all residents to reflect on the education quality, competence acquisition and readiness to work as an independent anaesthesiologist. We also send other questionnaires to all teachers to assess the educational outcomes and war impact, efficacy of the different types of learning and reflection on what needs to be improved. Both questionnaires are in the supplement material.

The survey results were imported into a Microsoft Excel spreadsheet for further analysis. Simple descriptive statistics were used for demographic data and numerical answers to individual questions, categorical data are presented as proportions. Statistical analysis was performed with Statistica 8.0

program. The Chi-square test was used to determine the normality of the data distribution in the sample, and most of the results in the study are nonparametric. The Kruskal-Wallis test to compare differences between multiple groups, Mann-Whitney test to compare differences between two groups and the Fisher double test to compare proportions were used. The probability of error (p) was considered insignificant at  $p < 0.05$ .

## Results

38 residents in 2021 and 36 residents in 2022 were included in the study. All of them have passed the OSCE. Questionnaires were sent to 38 residents in 2021 and 36 residents in the 2022 year. Afterwards, we receive 25 answers in 2021 and 28 in 2022, the response rate was 65% and 78% respectively. 15 teachers were included in the study, the response rate was 100%.

The results of the OSCE exam are presented in Table 2 and Graph. 1. The number of residents, who didn't pass the OSCE did not differ significantly ( $p=0,9$ ).

The number of residents who had 70-80% competence acquisition were a significant lower in 2022 year ( $p=0,039$ , OR 0,36 95% CI 0,1-0,9), although the number of resident, who had 80-90% and more than 90% competence acquisition had a tendency to increase ( $p>0,05$ ).

**Table 2. Objective structural clinical exam results in final year residents 2021 and 2022**

<b>Competences passed</b>	<b>&lt;70%</b>	<b>70-80%</b>	<b>80-90%</b>	<b>&gt;90%</b>
2021	5/33 (13%)	22/16 (58%)	7/31 (18%)	4/34 (10%)
2022	5/31 (14%)	12/24 (33%)	14/22 (39%)	5/31 (14%)
p	1	0,039	0,07	0,7
OR CI 95%	0,9 [0,25-3,6]	0,36 [0,1-0,9]	2,8 [1-8]	1,3 [0,3-5,5]

As shown in Table 3, the satisfaction with the practical and theoretical training outcomes had no significant difference between 2022 and 2021 final year residents, and practical outcomes even tended to be higher in 2022 graduates.

**Table 3. Educational outcomes self-evaluation by the final year residents**

Educational outcomes evaluation by the final year residents (10-score scale)	2022	2021	p-value <sup>1</sup>
Theoretical training outcome – the score 7 and more	93% (27/1)	87% (24/1)	1
Practical training outcome – the score 7 and more	93% (27/1)	80% (20/5)	0.08

*1-Fisher two-tailed test*

To assess the competence-based education efficacy we asked residents to evaluate their readiness to work independently in different clinical situations (Table 4). The number of residents, who feel absolutely confident to provide anaesthesia for ASA 1-2 patients, ASA 3-4 patients and to work independently in the ICU, did not change significantly, although tended to increase in the 2022-year residents ( $p>0,05$ ).

**Table 4. Residents' self-evaluation of the readiness to work independently in different clinical situations**

Evaluation points	My competences need to be improved	I have enough knowledge, but need to improve my practical skills	Feel absolutely confident
Readiness to provide anesthesia independently for ASA 1-2 patient (residents 2022 final year)	3% (1/27)	22% (6/22)	75% (21/7)
Readiness to provide anesthesia independently for ASA 1-2 patient (residents 2021 final year)	4% (1/24)	24% (6/19)	72% (18/7)
P, OR 95% CI	1.00; 0.88 [0.05-15.00]	0.92; 0.86 [0.23-3.12]	1.00; 1.16 [0.34-3.96]
Readiness to provide anesthesia independently for ASA 3-4 patient (residents 2022 final year)	10% (3/25)	65% (18/10)	25% (7/21)
Readiness to provide anesthesia independently for ASA 3-4 patient (residents 2021 final year)	10% (3/22)	62% (15/10)	28% (7/18)
P, OR 95% CI	1.00; 0.88 [0.16-4.81]	0.78; 1.20 [0.39-3.65]	1.00; 0.85 [0.25-2.90]
Readiness to work independently in the general ICU (residents 2022 final year)	14% (4/24)	32% (9/19)	54% (15/13)
Readiness to work independently in the general ICU (residents 2021 final year)	16% (4/21)	40% (10/15)	44% (11/14)
P, OR 95% CI	1.00; 0.87 [0.19-3.93]	0.57; 0.71 [0.23-2.19]	0.58; 1.46 [0.49-4.34]

$p > 0,05$ , Fisher two-tailed test

The residents also had to choose the topics they want to know better at the end of their education. While the teachers were supposed to choose, which topics, to their consideration, need more detailed learning.

The results could be seen in the Graph.2 below.

The majority of 2022-year residents wish to improve their knowledge in intensive care. While teachers as well considered that this topic requires more detailed learning. Nevertheless, while asking residents what skills they feel the need to improve, most of them (46%) showed the desire to improve their skills in peripheral nerve blocks. We suggest, that 2021 residents want to know more about respiratory support (40%), because they have a lot of patients with COVID-19, while residents-2022 become more interested in regional anaesthesia, as the number of trauma patients increased due to war. (Graph. 3)

When it comes to competence acquisition assessed by teachers: 44% accordingly stated that it was higher in 2022 residents comparing to previous years, while 63% answered that it remained the same. Teachers evaluate the residents competences and readiness for independent practice by giving a score on a scale from zero to five, where is 0 - absolutely not enough and 5 – absolutely enough (Graph 4). In 2021, 13% of the answers (2 out of 15) scored 2 points, 27% (4 out of 15) – three points and 60% (9 out of 15) considered residents` skills to be almost absolutely enough, giving the score 4. This last number increased in 2022 to 73% (11 responses from 15,  $p=0,69$ ), while the scores below 3 were absent at all ( $p=0,48$ ).

Teachers and residents had similar reflection about the most effective type of learning (Graph 5), choosing the simulation training, live master classes, seminars in small groups and self-directed learning, while live lectures in a large group was the least effective.

## Discussion

The effects of war represent significant challenges for national education systems [6]. As UNESCO emphasized in its study [6], there is a direct correlation between the presence of conflict in the country, the amount of population with formal education and the average number of obtained years of education. Dobiez and authors [5] in their study divide all the obstacles to medical education in wartime (which are considered quite similar throughout the conflicts in different countries) into five categories – problems with the schedule, students and teachers safety, manpower, the general quality of provided education and the resources.

However while the education and consequently the attendance of educational facilities in most of the countries have been affected by the conflicts happening there, there are some countries, which managed to keep their educational national trends on the unchanged level even during the war. The research of Miguel and Roland [4] on the long-term impact of bombing in Vietnam has also shown that there was no significant difference in literacy while comparing non-bombed and the most bombed areas. These studies have proven that while the countries are at war it is still possible to keep education going. And UNESCO`s research demonstrated that it should be done in order to secure the future of the country and its population. There may be numerous reasons why some countries are more affected by war conflict in comparison to others.



We suggest that war didn't have an impact on the residents-2022 competence acquisition due to multiple factors. At first, residents had more time for self-directed study and practical time in the hospital. Other authors also report that about two-thirds of residents chose self-study as their primary modality of learning, when a smaller percentage of residents preferred to learn from more traditional teaching methods such as lectures and discussions<sup>8</sup>. Secondly, due to safety reasons, the place of practical work in the hospital become flexible, so residence could choose the city and hospital they have to work. To our knowledge, there are no other studies, who investigate the war impact on residents competence acquisition.

Regarding residents preferences, there are other studies with similar results, showing that residents are frequently encountering program mandated didactic lessons, which are consistent with their preferred study methods [7]. Usually they prefer bedside clinical teaching, resident lead study sessions, self-directed learning and workshops [8]. In our study, residents, as well as teachers, prefer small group seminars, workshops, simulation training and self-directed learning.

Limitations to this study were small sample size and limited response rate. Another limitation was simple statistical analysis. Larger studies could include a higher number of participants with more complex methods of statistical analysis.

## Conclusion

While the war affects greatly educational process, as well as others civilian activities, anaesthesiology and intensive care residents could get all necessary competences and become ready for independent work during ongoing full-scale war, with increasing part of practical work in the hospital, introduction flexible hospital practice places (temporary moving to safe country regions) and sparing more time to online sessions and self-directed study.

## Declarations

**-Ethical approval and consent to participate:** All experimental protocols were approved by Bogomolets National Medical University ethics committee (protocol #146, 07.09.21). All methods were carried out in accordance with relevant guidelines and regulations(e.g. Declaration of Helsinki). Informed consent was obtained from all subjects participating in the study.

**-Consent to publish:** Not Applicable

**-Availability of data and material:** The datasets used and/or analysed during the current study available from the corresponding author on reasonable request

**-Conflict of interest:** No, I declare that the authors have no competing interests as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper

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**-Author's contribution:** K.B. and U.K. wrote the main manuscript, I.K.prepared figures. All authors reviewed the manuscript

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## Graph

Graphs 1-5 is available in the Supplementary Files section.